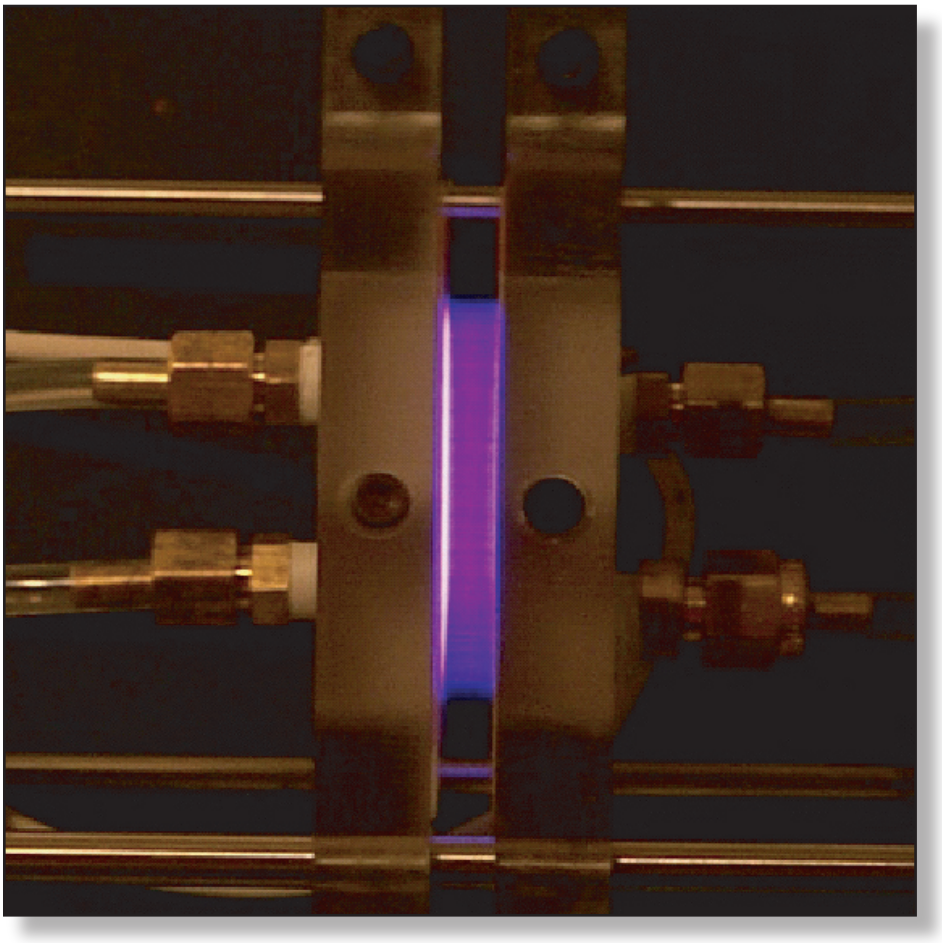
Air Force Research Laboratory|AFRL
Science and Technology for Tomorrow's Air and Space Force

Success Story

REVOLUTIONARY PLASMA METHOD IMPROVES DECONTAMINATION TECHNIQUES



Decontaminating equipment or gear exposed to biological warfare agents is an incredibly time-consuming and cumbersome process. However, for those on the front lines and elsewhere, Dr. Mounir Laroussi developed a revolutionary method that uses plasma to speed up that process considerably. Plasma also promises to serve those in the military and civilian medical communities by decontaminating and sterilizing reusable medical tools that are heat sensitive.

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Accomplishment

In the 1990s, the AFRL Air Force Office of Scientific Research (AFOSR) began sponsoring Dr. Laroussi's plasma research. Dr. Bob Barker, program manager for AFRL AFOSR's Physics and Electronics Directorate, was visionary in foreseeing the value of the research and its potential use for the Air Force and military. Dr. Laroussi, an Old Dominion University associate professor of electrical and computer engineering, has been looking for a way to improve decontamination techniques for years.

Conventional decontamination techniques rely on extreme heat or chemicals to deal with biohazards and can be time consuming. Plasma is formed when enough energy is added to a gas to free electrons from a significant number of atoms or molecules. This process, known as ionization, creates a mixture of positively charged particles, negatively charged particles, and various uncharged particles. Among these particles are high concentrations of free radicals, which can quickly overwhelm the natural defenses of living organisms, leading to the organism's destruction. This makes plasma a very efficient decontamination agent that can be applied anywhere in a few seconds to minutes.

Hospitals use toxic gases such as ethylene oxide as a method of sterilization. This time-consuming, environmentally unsafe process can require up to 24 hours for the gases and residues to dissipate. In addition, medical professionals working in makeshift hospitals near the battlefield often do not have excess sterilized equipment. Plasma would allow these individuals to reuse their equipment repeatedly, since the tools can be sterilized in just a few minutes.

Background

When Dr. Laroussi's plasma research started in the 1990s, there were few researchers in this area of study. Now this research is common among research groups around the world.

Decontamination is not the only advantage of plasma use. Researchers foresee using plasma in aerodynamic applications to reduce drag, thereby saving fuel. Scientists also discovered that in as little as 10 seconds, high concentrations of bacteria can be killed after exposure to plasma. Other tests have demonstrated that plasma can neutralize microorganisms similar to anthrax and bacteria such as Escherichia coli (commonly referred to as E. coli). Its use also may prove effective in destroying prion, the protein linked to "mad cow disease."

Office of Scientific Research
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Additional Information

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